ORBUMP 3D Magnetic Analysis

V.S.Kashikhin, June 15, 2004

Magnet parameters:

Field in the center	0.28 T
Air gap	65.1 mm
Maximum current	15 kA
Inductance	1.84 10^{-6} H

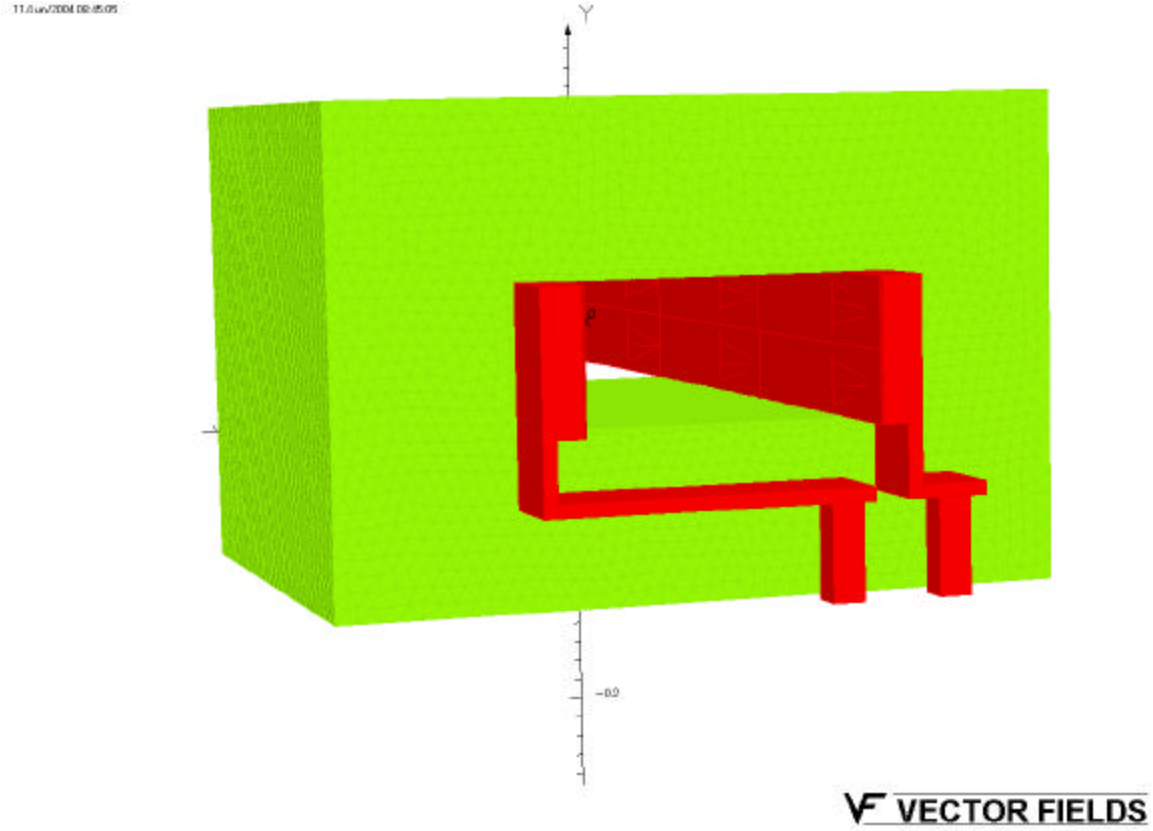

Fig. Magnet model geometry (ORBUMP_060804_reduced.op3)

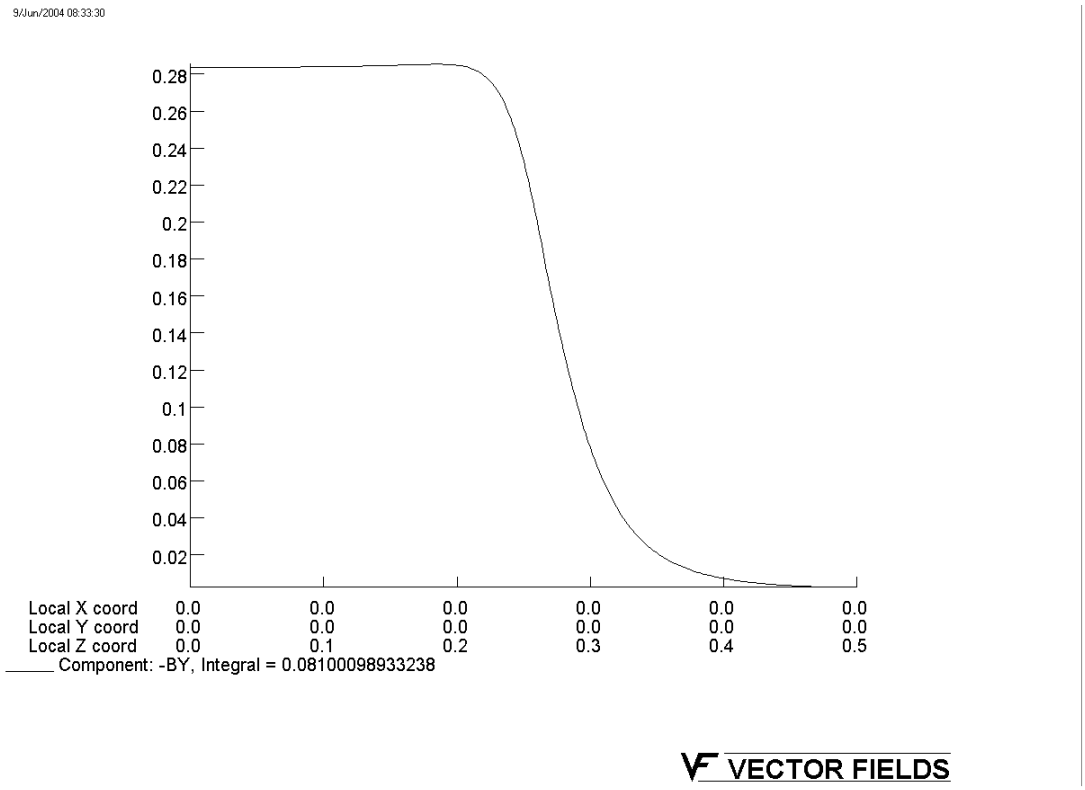

Fig. 2. **By** field distribution in Z direction

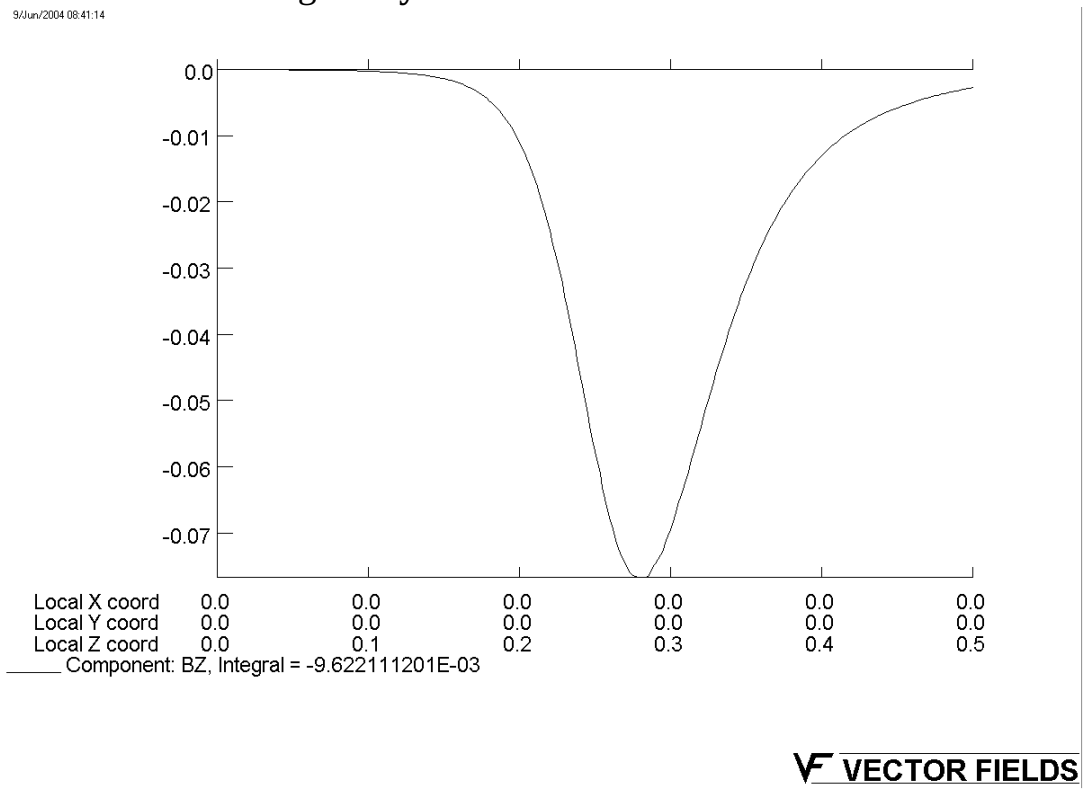

Fig. 3. **Bz** field distribution in Z direction

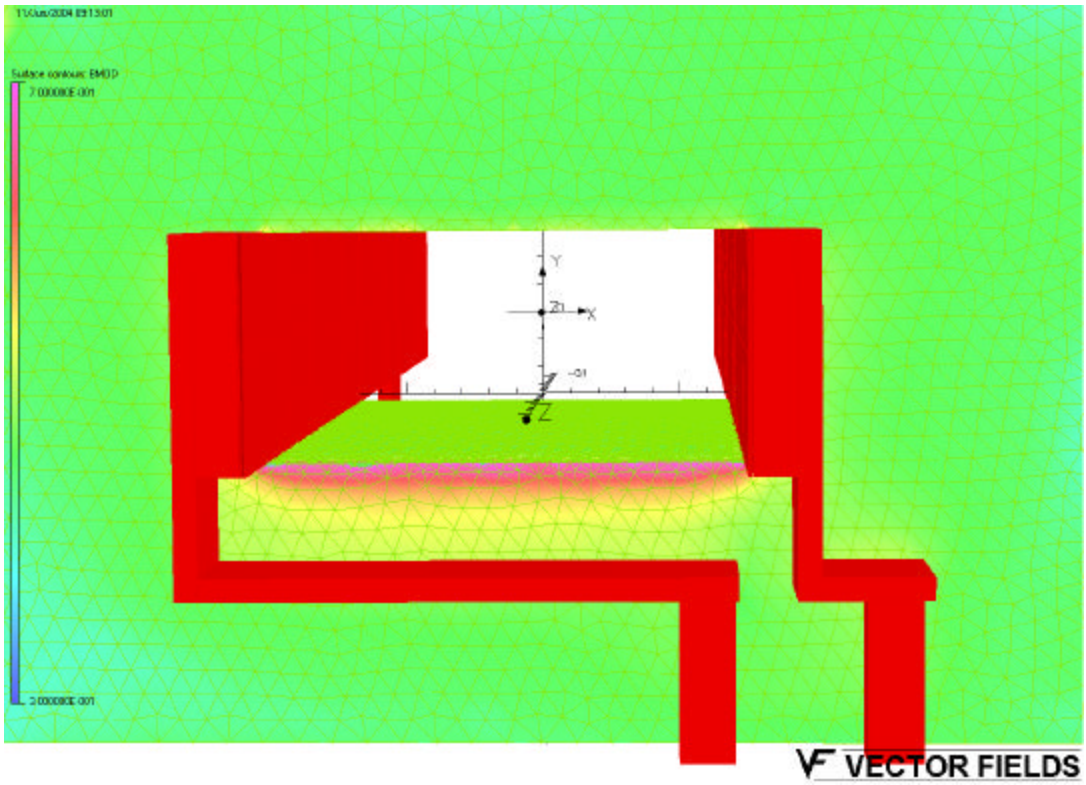

Fig. 4 Non-symmetrical magnet end saturation effect

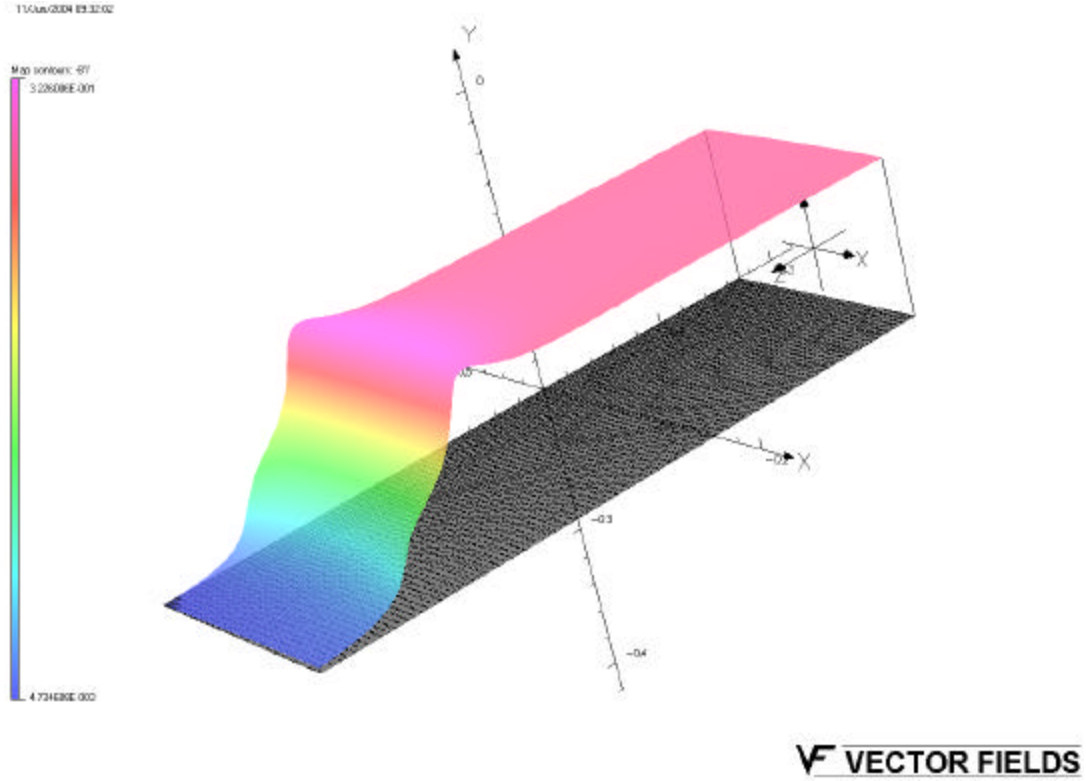

Fig. 5. **By** field histogram at Y=-25.4 mm

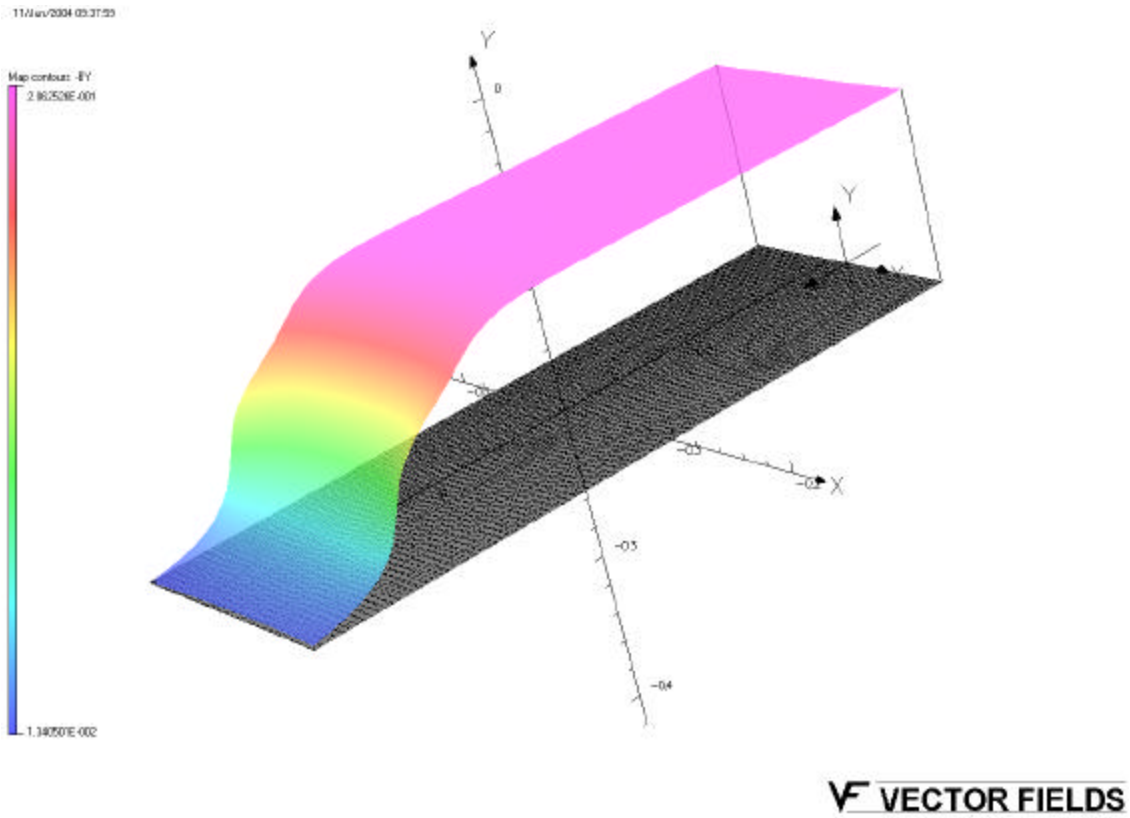

Fig. 6. **By** field histogram at Y=0 (magnet middle plane)

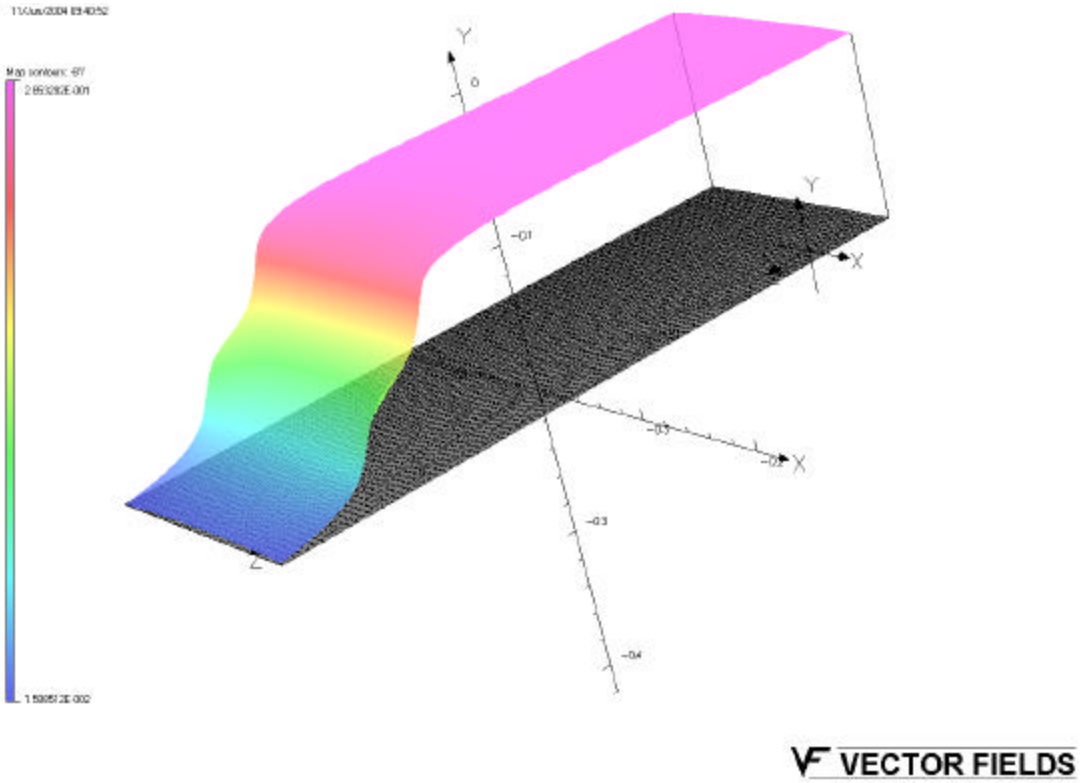

Fig. 7. **By** field histogram at Y=25.4 mm

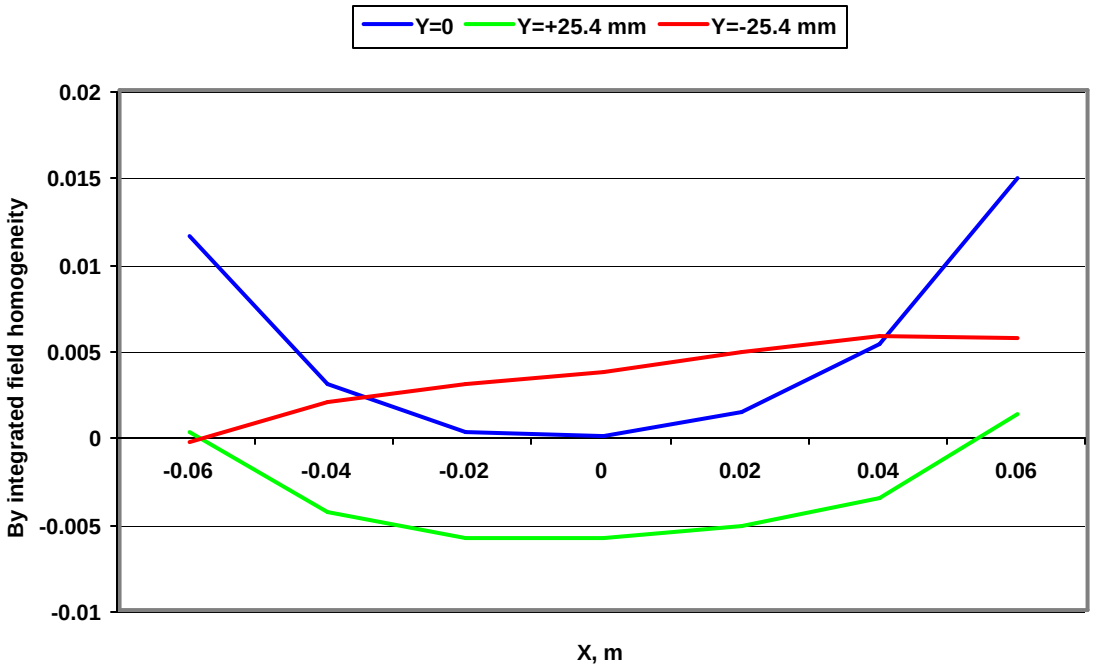

Fig.8. Integrated **By** field homogeneity. Only lead end related to the whole magnet length.

Magnet with improved current leads

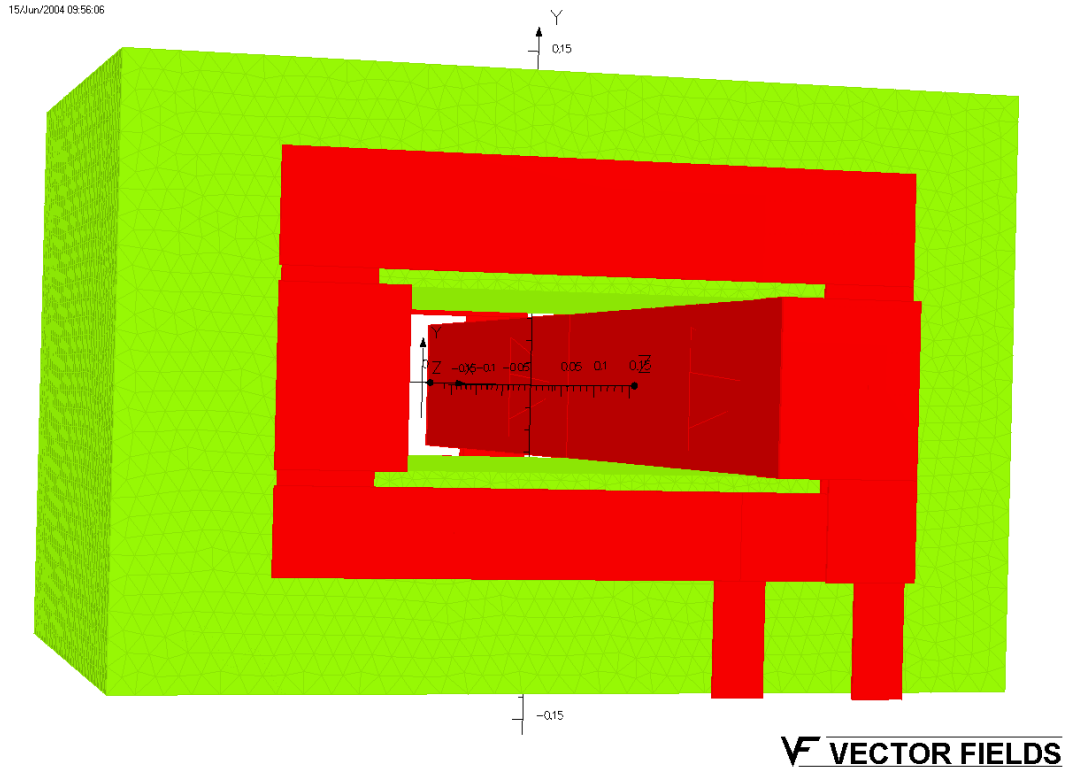

Fig. 9. Model geometry with improved current leads (ORBUMP_061404_reduced.op3)

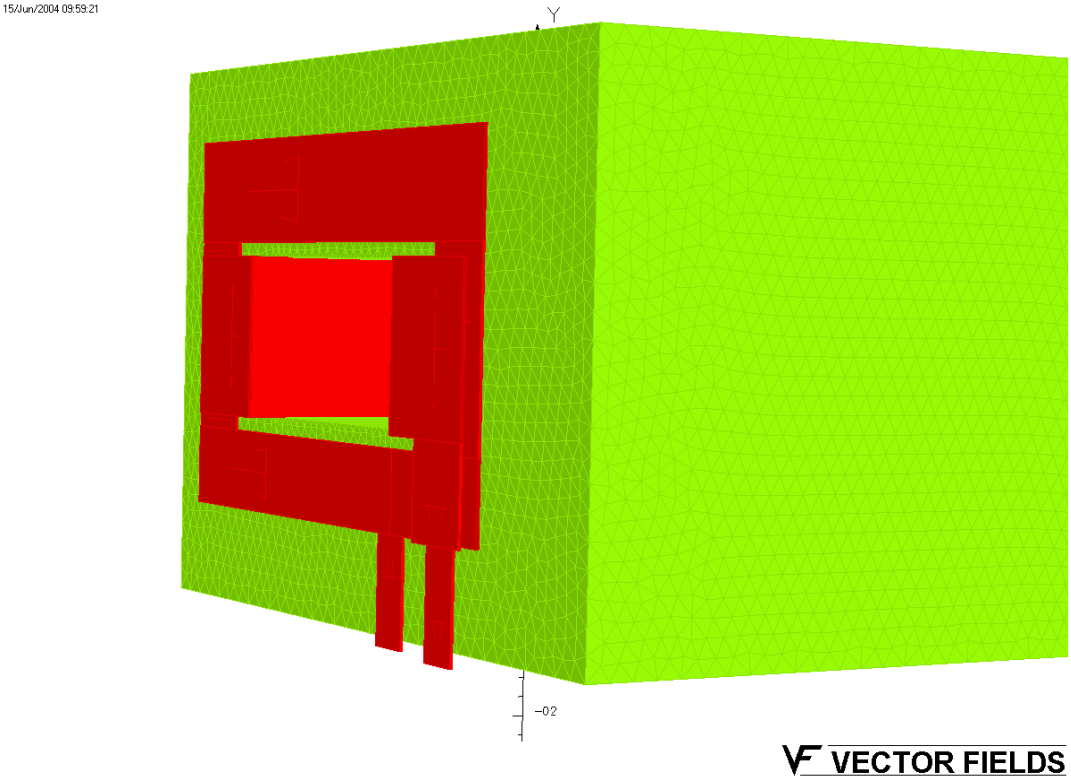

Fig. 10. Model geometry with improved current leads

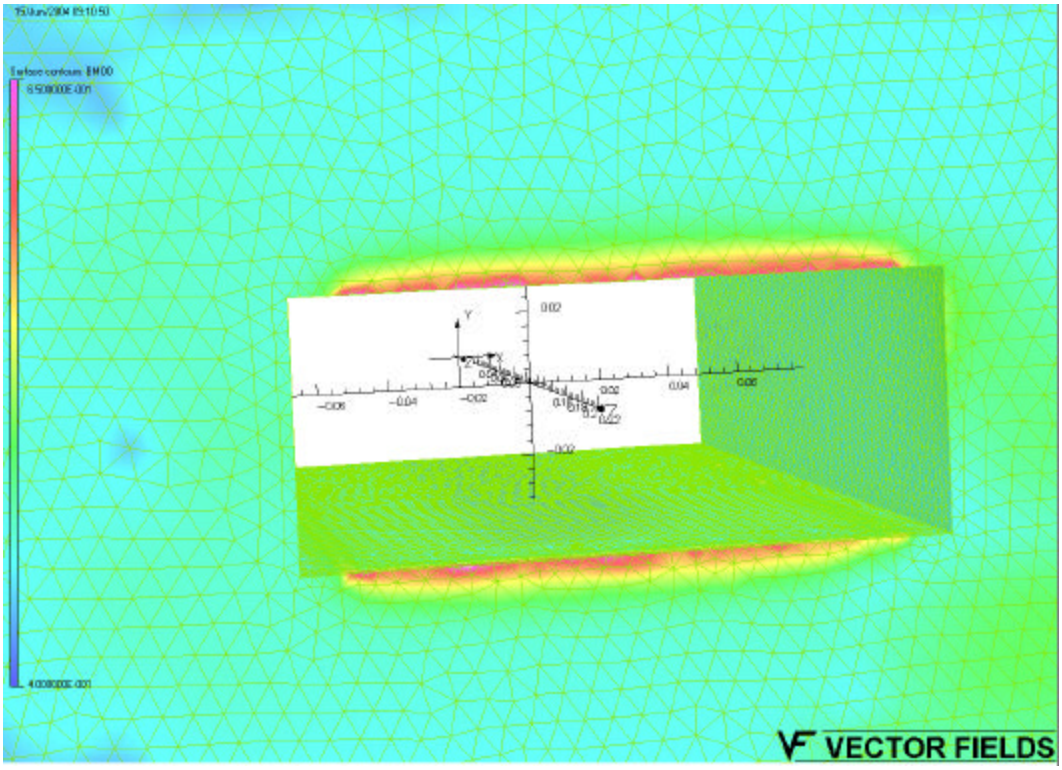

Fig. 11. Ferrite flux density at the magnet end

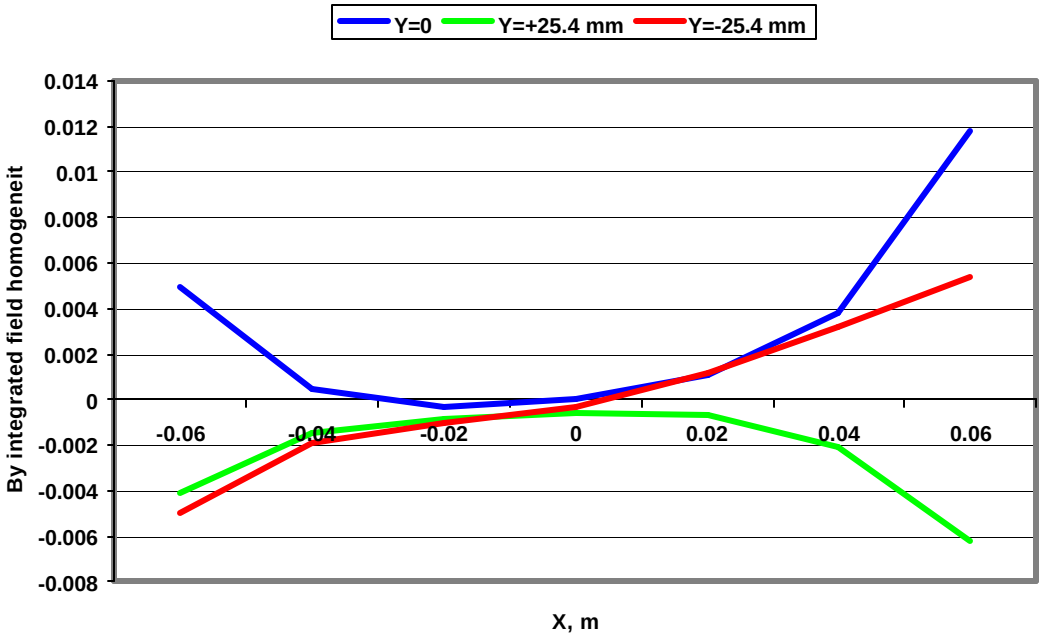

Fig.12. Integrated **By** field homogeneity. Only lead end related to the whole magnet length.

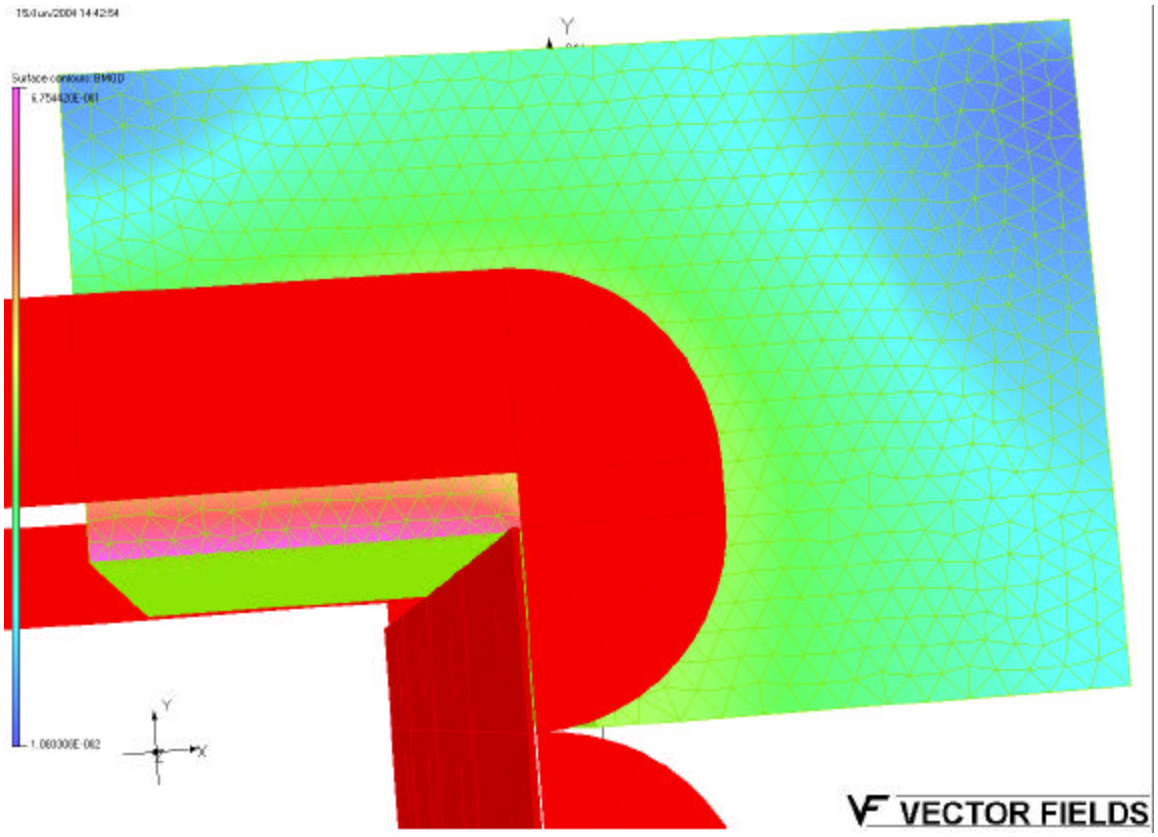

Fig. 13. Symmetrical end flux density distribution

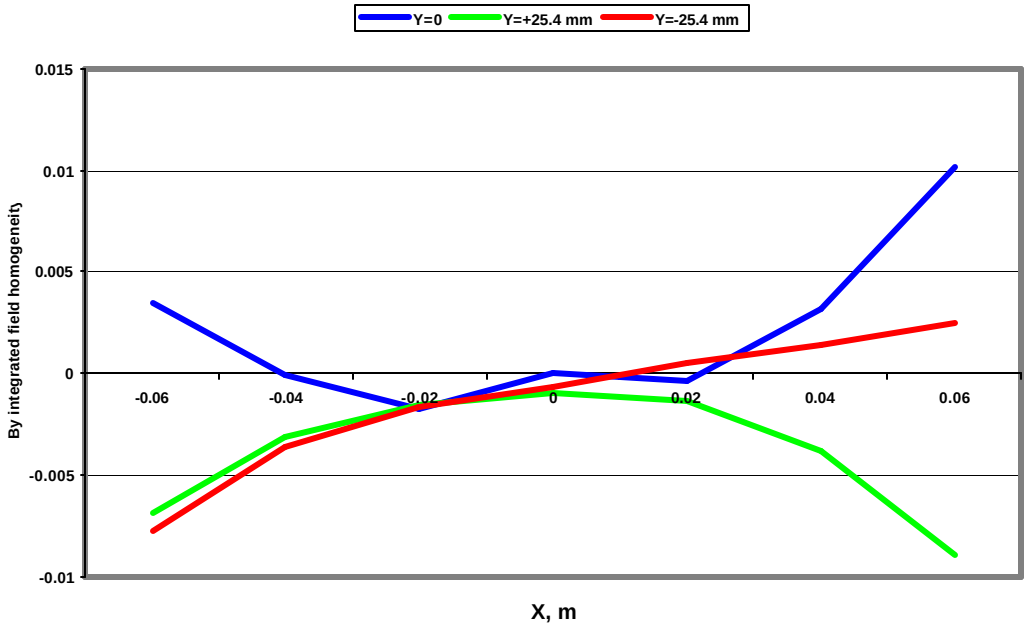

Fig.13. Integrated **By** field homogeneity. Total magnet length with both symmetrical and lead ends.

Summary

3D magnetic field analysis was made for stationary field at 15 kA current. The coil eddy current effects were modeled by 1 mm thick transport current, which is equal the skin depth at specified frequency. The results show +/-1% integrated field non-homogeneity mostly caused by current leads. The TOSCA code was used for these simulations with 2.7 million finite elements and ~ 5 hours of CPU time. On the base of these calculation the coil lead end was redesigned. The 3D transient field analysis will be made later to simulate the eddy current effects in a more accurate way.